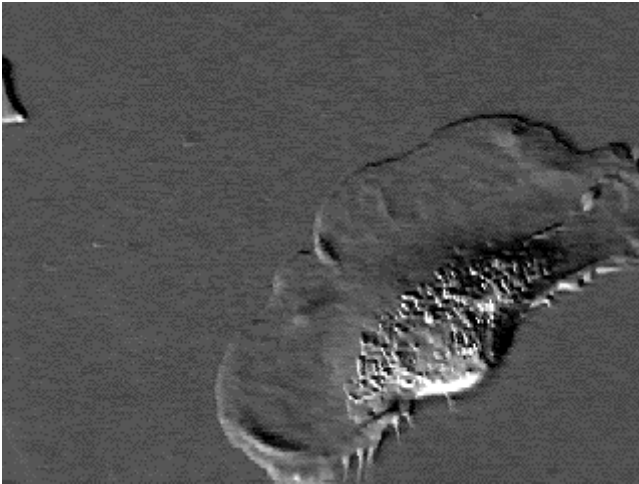
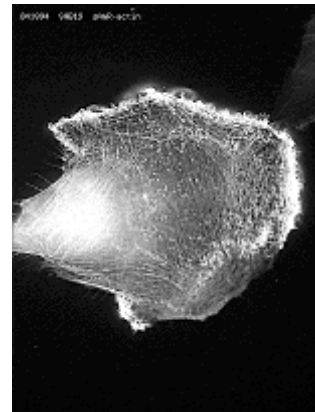


Dynamic Processes: Cell Migration

Cell Motility



Fluorescently marked actin



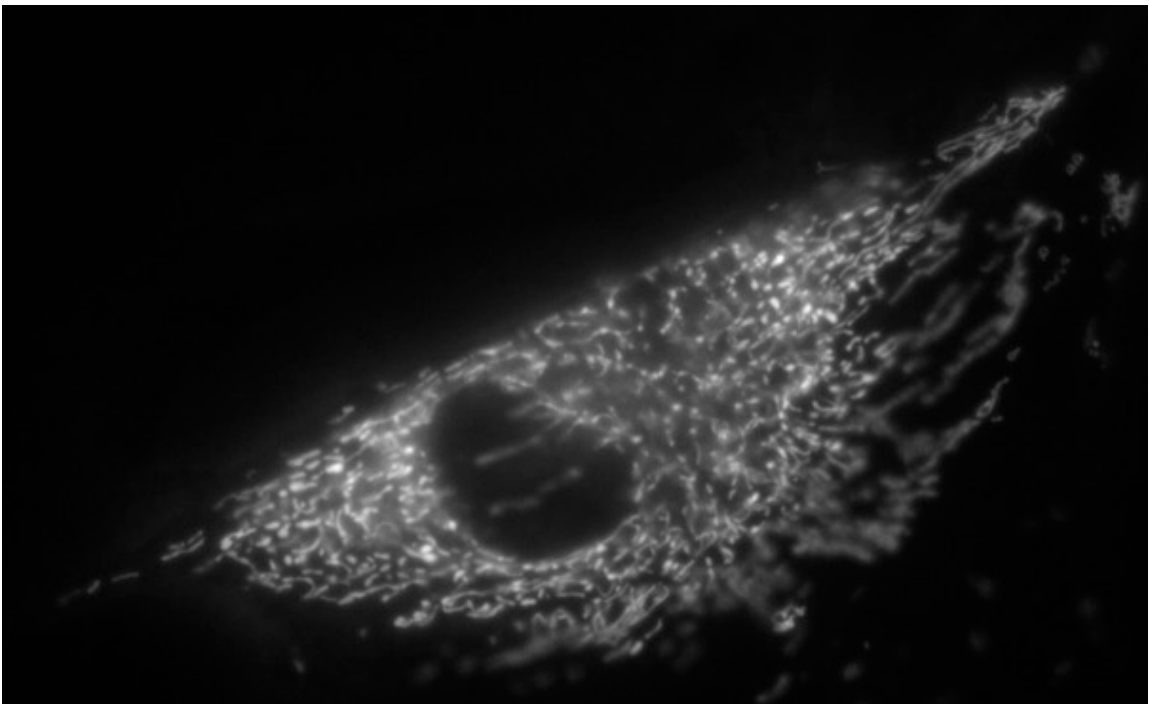
- Actin is a polymer
- The cytoskeleton is active
- Coordinated processes: adhesion, (de-) polymerization

Active Cell Contraction



Cardiac myocyte (Jan Lammerding)

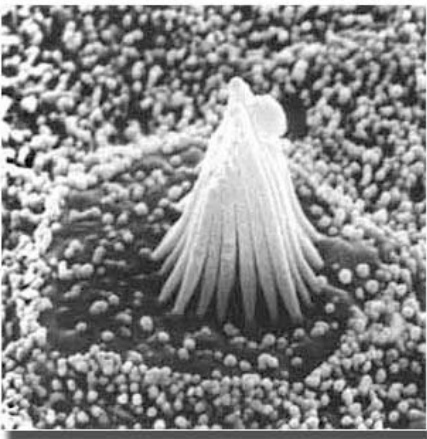
Cytoskeletal Mechanics Probed by External Force



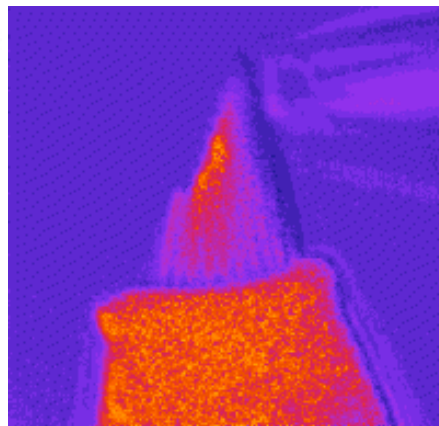
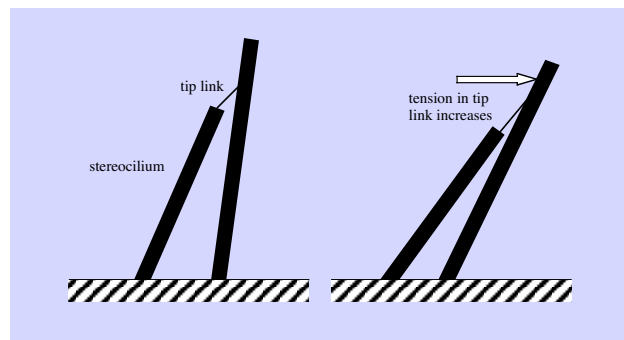
Fibroblast with fluorescent mitochondria forced by a magnetic bead

D. Ingber, P. LeDuc

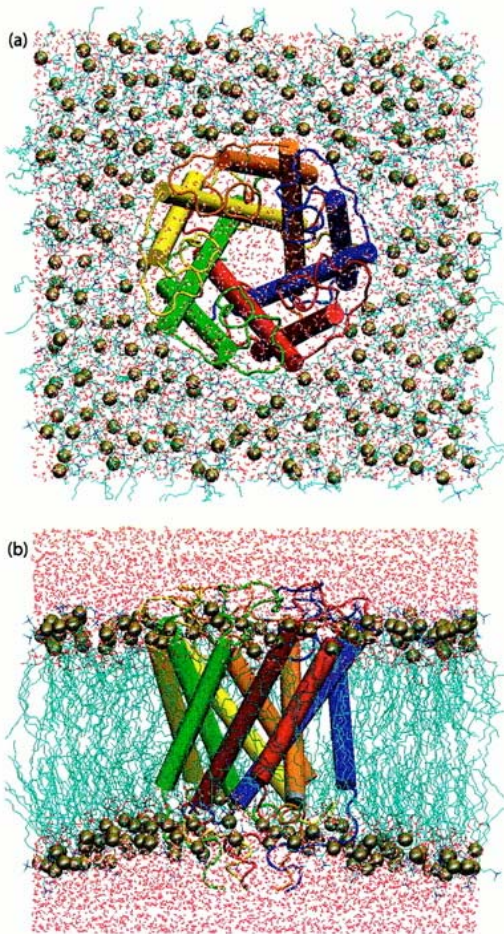
Mechanotransduction: Hair cell stimulation



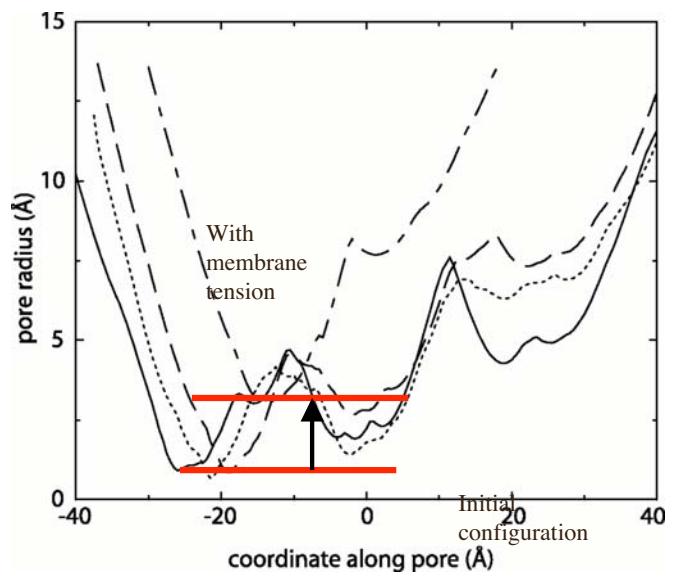
SEM of the stereocilia on the surface of a single hair cell (Hudspeth)



Tension in the tip link activates a stretch-activated ion channel, leading to intracellular calcium ion fluctuations.



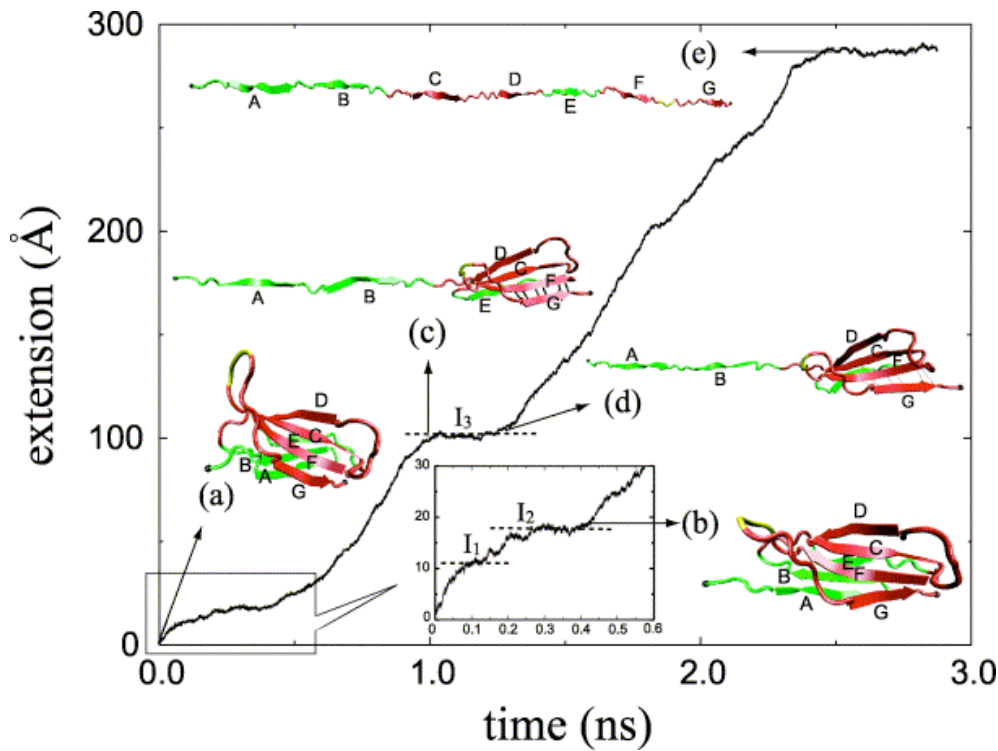
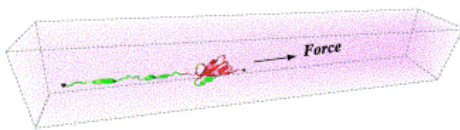
Molecular dynamics simulation
of channel regulation by
membrane tension
(Gullingsrud, et al., Biophys J, 2001)



*But other evidence suggests that the pore
increases to >20 angstroms!*

Steered molecular dynamics of fibronectin

(Gao, Craig, Vogel, Schulten, JMB, 2002)

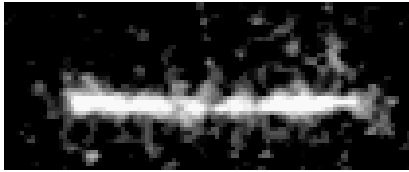


Constant applied force = 500 pN

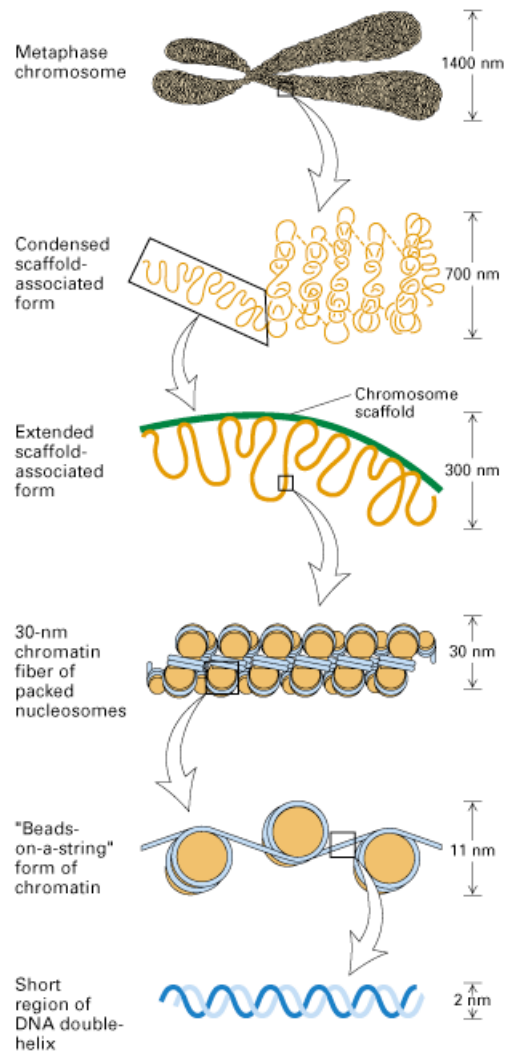
Unfolding has been thought to be important in exposing buried cryptic binding sites.

The Orders of Magnitude in DNA Organization

Compaction of a stretched DNA after histones are introduced.



Ladoux, Doyle et al. 2000

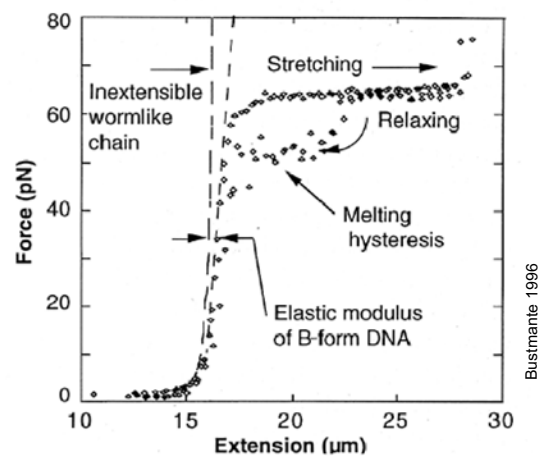


Dynamic Processes: Molecules

Single T4-phage
DNA in solution



Stretching a Single DNA



- Thermal forces are important ($kT/1 \text{ nm} \sim 4 \times 10^{-12} \text{ N}$)
- Entropic & enthalpic effects
- Generic/specific mechanical responses
- Single molecule experiments are possible